

Feeding Practices and Factors Associated with Malnutrition among Children Aged 6 - 59 Months in Isangi, Democratic Republic of the Congo

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Abstract

Introduction: Child malnutrition remains a major public health problem in low-income countries, particularly in sub-Saharan Africa. Inadequate feeding practices and household food insecurity are important determinants of malnutrition among children under five years of age. This study aimed to analyze feeding practices, the level of food insecurity, and factors associated with malnutrition among children aged 6 to 59 months in the Isangi territory, Democratic Republic of the Congo. **Methods:** An analytical cross-sectional study was conducted among 260 households with at least one child aged 6 to 59 months. Data were collected using a structured questionnaire covering socio-demographic characteristics, feeding practices, food security, and children's nutritional status. Statistical analysis was performed using logistic regression models to identify factors associated with different forms of malnutrition. **Results:** The prevalence of underweight and wasting was 21.15% and 25.77%, respectively. Most children (65.77%) had acceptable dietary diversity, but more than half received only one meal per day. All households reported experiencing periods of food shortage and reducing children's food portions. Multivariate analysis showed that acceptable dietary diversity was a strong protective factor against both underweight and wasting, whereas recent illnesses significantly increased the risk of malnutrition. **Conclusion:** Inadequate feeding practices and severe food insecurity are major determinants of child malnutrition in this rural setting. Strengthening community-based nutrition interventions and improving household food security are essential to reduce child malnutri-

tion.

Keywords

Child Malnutrition, Feeding Practices, Food Insecurity, Dietary Diversity, Children under Five, Rural Health, Democratic Republic of the Congo

1. Introduction

Child malnutrition remains one of the most concerning public health problems in low- and middle-income countries, particularly in sub-Saharan Africa. It mainly manifests as stunting, underweight, and wasting among children under five years of age. According to the United Nations Children's Fund, millions of children worldwide continue to suffer from various forms of malnutrition, with significant consequences on morbidity, mortality, and cognitive development [1]. Long-term consequences also include reduced human capital and lower productivity in adulthood [2].

The determinants of child malnutrition are multiple and interconnected. They include socio-economic factors, feeding practices, household food security, access to healthcare services, and environmental conditions [3] [4]. Among these factors, infant and young child feeding practices play a central role in children's growth and development. Inadequate feeding characterized by low dietary diversity or insufficient meal frequency is strongly associated with an increased risk of malnutrition [5] [6]. Several studies conducted in Africa have shown that minimum dietary diversity is an important protective factor against malnutrition among children under five years of age [7].

Furthermore, household food insecurity remains a major determinant of children's nutritional status in rural areas. It is reflected by limited food availability, reduced food portions, or a decrease in the number of meals consumed per day. In contexts of rural poverty, these food-related constraints particularly affect young children whose nutritional needs are high [5] [8]. Frequent childhood illnesses such as diarrheal and respiratory infections may also worsen malnutrition by reducing nutrient absorption and increasing the body's energy requirements [9] [10].

In the Democratic Republic of the Congo, child malnutrition remains a major public health problem, especially in rural areas where socio-economic conditions and access to health services remain limited [11] [12]. Despite efforts undertaken in the field of nutrition, empirical data on household feeding practices and their relationship with child malnutrition remain limited in several regions of the country, particularly in Tshopo Province.

In this context, the present study aimed to analyze feeding practices and factors associated with malnutrition among children aged 6 to 59 months in the Isangi territory, Democratic Republic of the Congo.

2. Methods

2.1. Study Design and Setting

An analytical cross-sectional study was conducted in the Isangi territory, located in Tshopo Province in the northeastern part of the Democratic Republic of the Congo. This territory is characterized by a rural environment where populations mainly depend on subsistence farming, fishing, and the exploitation of natural resources for food and livelihoods. Socio-economic conditions are generally precarious, and access to healthcare services remains limited.

The study was conducted in several villages of the Isangi territory to assess household feeding practices, food security, and their relationship with the nutritional status of children aged 6 to 59 months.

2.2. Study Population and Sampling

The target population consisted of households with at least one child aged 6 to 59 months living in the study area at the time of the survey. Children suffering from severe illnesses during data collection or with incomplete information were excluded from the study.

The required sample size was calculated using the single population proportion formula:

$$n = Z_{\alpha}^2 \times \frac{p \times q}{r^2} \times f$$

where $Z = 1.96$ corresponding to a 95% confidence level, $p = 16.5\%$, representing the prevalence of chronic malnutrition reported in Isangi Territory, $d = 5.5\%$ margin of error, and a design effect (DEFF) of 1.5 to account for cluster sampling. The minimum required sample size was estimated at 263 children.

A multistage cluster sampling procedure was used.

The study covered the four health zones of Isangi Territory: Isangi, Yabaondo, Yakusu, and Yahisuli. Sample allocation was proportional to the estimated number of children aged 6 - 59 months in each health zone. Based on the target population of 132,233 children aged 6 - 59 months, the sample was distributed as follows: 74 children in Isangi Health Zone, 74 in Yabaondo, 73 in Yakusu, and 42 in Yahisuli.

Health Zone Population of children (6 - 59 months) Proportion (%) Allocated sample			
Isangi	36,833	27.9	74
Yabaondo	37,373	28.3	74
Yakusu	36,530	27.6	73
Yahisuli	21,497	16.2	42
Total	132,233	100	263

During the first stage, two villages were selected within each health zone using probability method. In the second stage, households with at least one child aged 6 - 59 months were identified through community listings prepared with the assis-

tance of community health workers. Eligible households were selected by simple random sampling. When more than one eligible child lived in the household, one child was randomly selected using a simple lottery method.

Ultimately, complete data were obtained from 260 households, which constituted the final analytical sample.

A total of 260 households were included in the study. Participants were selected using a random sampling method in the selected villages. When several eligible children were present in the same household, only one child was selected for the survey.

2.3. Data Collection

Data were collected using a structured questionnaire administered to mothers or primary caregivers of the child. The questionnaire included information related to household socio-demographic characteristics, feeding practices, household food security, and recent history of childhood illnesses.

Feeding practices were assessed through dietary diversity and meal frequency consumed by the child. Dietary diversity was estimated based on the food groups consumed by the child during the previous 24 hours. Minimum dietary diversity was considered acceptable when the child had consumed at least four food groups.

Children's nutritional status was assessed using anthropometric indicators recommended by the World Health Organization. The nutritional indices analyzed in this study were weight-for-age (underweight) and weight-for-height (wasting).

Children with a Z-score below -2 standard deviations from the WHO growth standards were considered malnourished.

Weight was measured using a calibrated SECA digital scale with a precision of 100 g. Length/height was measured using a portable UNICEF height board to the nearest 0.1 cm. All measurements were taken twice by trained field workers following WHO standardized procedures, and the average value was retained. Weight-for-age and weight-for-height Z-scores were generated using WHO Anthro software based on the 2006 WHO Child Growth Standards.

2.4. Study Variables

The main dependent variable was children's nutritional status, measured by underweight and wasting.

Independent variables included dietary diversity, meal frequency, recent childhood illnesses, and household socio-demographic characteristics (household size, sex of household head, and child age).

2.5. Statistical Analysis

Data were entered in Microsoft Excel 2016 and analyzed using Stata version 13. Descriptive analysis was performed to describe household characteristics and the prevalence of different forms of malnutrition. Associations between independent variables and children's nutritional status were assessed using the chi-square test.

Logistic regression analysis was then performed to identify factors independently associated with malnutrition.

Variables associated with the outcome at $p < 0.05$ in the bivariate analysis, were entered into the multivariable logistic regression model. Backward elimination was then performed while retaining known confounders irrespective of statistical significance.

Results were presented as odds ratios (ORs) with their 95% confidence intervals. Statistical significance was set at $p < 0.05$.

2.6. Ethical Considerations

Participation in the study was voluntary, and informed consent was obtained from parents or guardians before data collection. Confidentiality of the collected information was ensured throughout the study.

3. Results

3.1. Sociodemographic Characteristics of Households and Children

The study included 260 children aged 6 to 59 months from households living in the Isangi territory. Among them, 141 (54.2%) were male and 119 (45.8%) were female. Most households were headed by men (84.2%). Households were generally large, with 58.5% having seven members or more. The sociodemographic characteristics of the study participants are presented in **Table 1**.

Table 1. Distribution of respondents according to sociodemographic characteristics.

Variables	Categories	Frequency	Percentage
Child sex	Male	141	54.23
	Female	119	45.77
Child age (months)	6 - 11	60	23.08
	12 - 59	200	76.92
Sex of household head	Male	219	84.23
	Female	41	15.77
Educational level of household head	None	3	1.15
	Primary	131	50.38
	Secondary	120	46.15
	Higher/University	6	2.31
Marital status of household head	Living alone	20	7.69
	Living with spouse	240	92.31
Main household income source	Agriculture	55	21.15
	Trade	4	1.54
	Informal activities	176	67.69
	Fishing	2	0.77
	Salaried employment	23	8.85
Household size	Less than seven	108	41.54
	Seven or more	152	58.46

3.2. Nutritional Status, Feeding Practices, and Medical History

The prevalence of underweight and wasting was 21.15% and 25.77%, respectively. Most children (65.77%) had acceptable dietary diversity. However, more than half of the children (52.69%) received only one meal per day.

Nearly all children had been exclusively breastfed (95.77%), while 92.31% had received vitamin A supplementation and 92.69% had received deworming treatment. Only 15.77% of children were fully vaccinated according to the immunization schedule.

Regarding morbidity, 61.92% of children had experienced recent illnesses during the previous two months, mainly fever (60.00%) and diarrhea (53.46%). The distribution of nutritional status, feeding practices, and medical history is presented in **Table 2**.

Table 2. Nutritional status, feeding practices, and medical history of children.

Variables	Categories	Frequency	Percentage
Underweight	Yes	55	21.15
	No	205	78.85
Wasting	Yes	67	25.77
	No	193	74.23
Acceptable dietary diversity	Yes	171	65.77
	No	89	34.23
Diversified foods consumed	Cereals, roots, tubers	238	91.54
	Milk and dairy products	99	38.08
	Vegetables	230	88.46
	Vitamin A-rich fruits	181	69.62
	Meat, fish, and eggs	138	53.08
	Nuts, seeds, and legumes	64	24.62
	Other fruits	41	15.77
Child ate yesterday	Yes	260	100.00
Exclusive breastfeeding	Yes	249	95.77
	No	11	4.23
Number of meals/day	1	137	52.69
	2	111	42.69
	≥3	12	4.62
Vitamin A supplementation	Yes	240	92.31
	No	20	7.69
Deworming	Yes	241	92.69
	No	19	7.31
Vaccinated according to schedule	Yes	41	15.77
	No	219	84.23

Continued

	Yes	161	61.92
	No	99	38.08
Recent illnesses (2 months)	Diarrhea	139	53.46
	Fever	156	60.00
	Respiratory infections	14	5.38

3.3. Factors Associated with Malnutrition

Child age was the factor most strongly associated with underweight. Children aged 12 to 59 months had an extremely high risk of underweight compared with children aged 6 to 11 months (OR = 61.78; $p < 0.001$).

Feeding practices also played a crucial role. Having acceptable dietary diversity was a strong protective factor against underweight. Children with acceptable dietary diversity were significantly less likely to be underweight compared with those with non-acceptable dietary diversity (OR = 0.02; $p < 0.001$). In addition, receiving two meals per day was a significant protective factor compared with receiving only one meal per day (OR = 0.04; $p = 0.044$).

Health and nutritional factors were major determinants of wasting. Acceptable dietary diversity significantly reduced the risk of wasting (OR = 0.015; $p < 0.001$). Vaccination status also emerged as a major protective factor: children vaccinated according to the immunization schedule had a considerably lower risk of wasting compared with non-vaccinated children (OR = 0.0062; $p = 0.005$).

However, the occurrence of recent illnesses during the previous two months dramatically increased the risk of wasting (OR = 21.56; $p < 0.001$). The bivariate analysis of factors associated with underweight and wasting is presented in **Table 3**, and the results of the multivariable logistic regression analysis are summarized in **Table 4**.

Table 3. Bivariate analysis of factors associated with malnutrition.

Variables	Underweight			Wasting		
	No	Yes	p-value	No	Yes	p-value
Child sex						
Male	109 (77.30)	32 (22.70)	0.508	107 (75.89)	34 (24.11)	0.506
Female	98 (80.67)	23 (19.33)		86 (72.27)	33 (27.73)	
Child age (months)						
6 - 11 months	59 (98.33)	1 (1.67)	<0.001	44 (73.33)	16 (26.67)	0.856
12 - 59 months	146 (73.00)	54 (27.00)		149 (74.50)	51 (25.50)	
Sex of household head						
Male	170 (77.63)	49 (22.37)	0.265	158 (72.15)	61 (27.85)	0.076
Female	35 (85.37)	6 (14.63)		35 (85.37)	6 (14.63)	
Educational level of household head						
None	2 (66.67)	1 (33.33)	0.704	1 (33.33)	2 (66.67)	0.017
Primary	100 (76.34)	31 (23.66)		89 (67.94)	42 (32.06)	

Continued

Secondary	98 (81.67)	22 (18.33)		97 (80.83)	23 (19.17)	
Higher and university	5 (83.33)	1 (16.67)		6 (100.00)	0	
Marital status of household head						
Living alone	15 (75.00)	5 (25.00)	0.661	14 (70.00)	6 (30.00)	0.653
Living with spouse	189 (78.75)	51 (21.25)		179 (74.58)	61 (25.42)	
Main source of household income						
Agriculture	28 (50.91)	27 (49.09)	<0.001	20 (36.36)	35 (63.64)	<0.001
Trade	3 (75.00)	1 (25.00)		4 (100.00)	0	
Informal activities	151 (85.80)	25 (14.20)		146 (82.95)	30 (17.05)	
Fishing	2 (100.00)	0		2 (100.00)	0	
Salaried employment	21 (91.30)	2 (8.70)		21 (91.30)	2 (8.70)	
Household size						
Less than seven members	89 (82.41)	19 (17.59)	0.236	90 (83.33)	19 (16.67)	0.005
Seven members or more	116 (76.32)	36 (23.68)		103 (67.76)	49 (32.24)	
Acceptable dietary diversity						
Yes	154 (90.06)	17 (9.94)	<0.001	155 (90.64)	16 (9.36)	<0.001
No	51 (57.30)	38 (42.70)		38 (42.70)	51 (57.30)	
Exclusive breastfeeding						
Yes	194 (77.91)	55 (22.09)	0.079	184 (73.90)	65 (26.10)	0.557
No	11 (100.00)	0		9 (81.82)	2 (18.18)	
Number of meals per day						
1	85 (62.04)	52 (37.96)	<0.001	72 (52.55)	65 (47.45)	<0.001
2	109 (98.20)	2 (1.80)		111 (100.00)	0	
≥3	11 (91.67)	1 (8.33)		10 (83.33)	2 (16.67)	
Vitamin A supplementation						
Yes	186 (77.50)	54 (22.50)	0.066	175 (72.92)	65 (27.08)	0.093
No	19 (95.00)	1 (5.00)		18 (90.00)	2 (10.00)	
Albendazole deworming						
Yes	187 (77.59)	54 (22.41)	0.078	177 (73.44)	64 (26.56)	0.302
No	18 (94.74)	1 (5.26)		16 (84.21)	3 (15.79)	
Vaccinated according to immunization schedule						
Yes	40 (97.56)	1 (2.44)	0.001	40 (97.56)	1 (2.44)	<0.001
No	165 (75.34)	54 (24.66)		153 (69.86)	66 (30.14)	
Recent illnesses (2 months)						
Yes	108 (67.08)	53 (32.92)	<0.001	96 (59.63)	65 (40.37)	<0.001
No	97 (97.98)	2 (2.02)		97 (97.98)	2 (2.02)	

Table 4. Adjusted factors associated with malnutrition.

Variables	Underweight			Wasting		
	Adjusted OR	95% CI	p-value	Adjusted OR	95% CI	p-value
Dietary diversity						
Non-acceptable	1	—	—	1	—	—
Acceptable	0.02	0.001 - 0.08	<0.001	0.015	0.0038 - 0.064	<0.001

Continued

Number of meals per day						
1 meal	1	—	—	—	—	—
2 meals	0.10	0.01 - 0.91	0.044	—	—	—
≥3 meals	0.12	0.001 - 11.74	0.369	—	—	—
Vaccination status						
Not vaccinated	1	—	—	1	—	—
Vaccinated	0.05	0.002 - 1.40	0.080	0.0062	0.0002 - 0.22	0.005
Recent illnesses (last 2 months)						
No	1	—	—	1	—	—
Yes	5.89	0.71 - 48.82	0.100	21.56	15.61 - 30.87	<0.001
Child age (months)						
6 - 11 months	1	—	—	—	—	—
12 - 59 months	61.78	27.46 - 138.3	<0.001	—	—	—
Marital status of household head						
Living alone	1	—	—	1	—	—
Living with spouse	0.31	0.05 - 1.82	0.196	0.54	0.074 - 3.99	0.550
Household size						
<7 members	—	—	—	1	—	—
≥7 members	—	—	—	0.95	0.31 - 2.89	0.924

4. Discussion

This study aimed to analyze the factors associated with malnutrition among children aged 6 to 59 months in a rural setting characterized by specific socio-economic dynamics. The findings show that malnutrition remains an important public health problem in the study area. This situation is consistent with trends observed in several sub-Saharan African countries, where child malnutrition continues to be strongly influenced by socio-economic and dietary conditions [1] [3] [4].

One of the most important findings of this study concerns the role of dietary diversity in children's nutritional status. Children with acceptable dietary diversity had a significantly lower risk of underweight and wasting. Dietary diversity is recognized as an important indicator of diet quality and adequacy of nutrient intake. Several studies have demonstrated that diversified diets improve the intake of essential micronutrients and contribute to reducing the risk of malnutrition among children [5]-[7]. Studies conducted in different African settings have also confirmed the association between low dietary diversity and child malnutrition [4] [5] [7].

The number of meals consumed per day also appeared to be an important determinant of children's nutritional status. In this study, receiving at least two meals per day was associated with a significant reduction in the risk of underweight. This finding is consistent with international recommendations on infant and young child feeding, which emphasize the importance of adequate meal frequency to meet the high energy requirements during early childhood [13]. In food-insecure settings, insufficient meal frequency can rapidly lead to chronic energy deficiency, contributing to the development of malnutrition [14].

Children's health status was also identified as a major determinant of malnutrition. Children who experienced recent illnesses had a significantly higher risk of wasting. The relationship between infection and malnutrition is well documented in the scientific literature. Infectious diseases, particularly diarrheal and respiratory infections, may reduce appetite, impair nutrient absorption, and increase metabolic demands, thereby worsening children's nutritional status [10]. This phenomenon illustrates the vicious cycle between malnutrition and infection widely described in low- and middle-income countries [2].

Complete vaccination according to the immunization schedule showed a protective effect against wasting. Properly vaccinated children had a lower risk of acute malnutrition. Vaccination plays an essential role in preventing infectious diseases that may compromise children's nutritional status. Previous studies have shown that improving vaccination coverage indirectly contributes to reducing malnutrition by limiting childhood morbidity [9].

Overall, these findings confirm that child malnutrition is a multifactorial phenomenon involving dietary and health factors. Interventions aimed at improving dietary diversity and strengthening infant and young child feeding practices could significantly contribute to reducing malnutrition in rural communities.

The findings of this study suggest several important implications for public policies and malnutrition control programs. First, nutrition interventions should strengthen the promotion of dietary diversity and appropriate infant and young child feeding practices at the community level. Second, strengthening vaccination coverage and the prevention of childhood illnesses remains essential to reducing acute malnutrition.

This study has several strengths. First, it combines nutritional and health variables to provide an integrated analysis of the determinants of child malnutrition in a rural setting. Second, the use of logistic regression analysis made it possible to identify factors independently associated with different forms of malnutrition among children.

However, some limitations should be considered. The cross-sectional nature of the study does not allow formal causal relationships to be established between the studied factors and children's nutritional status. In addition, some feeding-related variables relied on household self-reporting, which may have introduced recall bias. Finally, because the findings are specific to the study area, caution should be exercised when generalizing the results to other contexts.

5. Conclusions

This study highlights the main determinants of malnutrition among children aged 6 to 59 months in the Isangi territory. The findings show that dietary diversity, meal frequency, recent morbidity and vaccination status significantly influence children's nutritional status. Children benefiting from diversified diets and adequate meal frequency had a significantly lower risk of underweight and wasting. Conversely, recent episodes of illness considerably increased the risk of acute malnutrition.

These findings confirm the multifactorial nature of child malnutrition, resulting from complex interactions between dietary and health. In this context, strategies to combat malnutrition should adopt an integrated approach combining improvement of feeding practices and strengthening preventive health services in order to sustainably reduce children's nutritional vulnerability.

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Author Contributions

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Conflicts of Interest

The authors declare that they have no conflict of interest related to this study.

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